Case Study

Year 2000 Preparation at Water and Wastewater Utilities

El Dorado Irrigation District

This case study report is part of a series of Year 2000 (Y2K) preparation case studies prepared for the EPA Office of Water and the State of California. These case studies review the process and status of Y2K preparations being performed by three water and/or wastewater utilities of varying sizes. The Y2K bug is the computer glitch that can cause computers and computerized equipment to not properly recognize the year 2000. For many years computer programmers used only the last two digits of the year when writing the date into computer code. When the year changes from 1999 to 2000, computers may read the year as 1900. As a result, computers and computerized equipment may shut down, malfunction, or simply perform business as usual. Computers that perform business as usual may encounter problems at other dates, however, such as February 29 (the year 2000 is a leap year, but 1900 was not). See the Appendix for a list of dates with possible Y2K problems.

The Y2K bug can affect numerous systems in water and wastewater utilities. Not only can the computer systems monitoring and controlling plant operations be non-compliant, but much of the plant equipment can also be non-compliant. Many devices, such as electronically controlled pumps and valves, may have computer chips embedded in them that have an internal clock. Sometimes this clock will show up on a digital display on the device, but many times it cannot be seen at all. In addition to all the embedded operating systems and computer controls, utilities have business-related computer hardware and software that can be affected, and they rely on vendors and suppliers who must also cope with Y2K issues.

With the vast amount of work that must be performed to prepare water and wastewater utilities for Y2K and the limited time in which the work must be done, these case studies are designed to assist utilities that are not as far along in their Y2K preparations. The utilities featured in these case studies are considered to be leaders with regard to the amount of work they have done to prepare for the Y2K bug and their progress toward finishing preparations. In their preparations, these utilities have learned from their experience, and these case studies are intended to pass on this knowledge.

Table of Contents

1. SYSTEM OVERVIEW

The utility featured in this case study is the El Dorado Irrigation District (EID), a publicly-owned water supply and wastewater treatment utility based in the foothills of the Sierra Nevada in California. EID's history dates back to the Gold Rush era when water was needed for mining, but the district was formally established in 1925 for agricultural purposes. Today EID provides water and wastewater services for agricultural, commercial, institutional, and residential customers. EID's service area covers approximately 200 square miles, and includes 29,100 water customers and 12,240 wastewater customers.

EID is governed by a Board of Directors that consists of five elected officials. The Board is responsible for all of the utility's activities including recommending rate changes and approval of all major funding decisions. Annual revenues for the district were $33.0 million in 1998. Its total expenditures for 1998 were $39.5 million, $19.8 million of which were for the operating budget, and $8.2 million of which went to capital improvements.

EID has three water treatment plants that are fed from multiple covered and uncovered reservoirs in the Sierra Nevada. The water treatment plants are gravity fed from these reservoirs, and most of their water distribution is also gravity feed. Their average daily demand is 30 million gallons, but it is significantly lower in the winter (10 to 12 MGD) since much of their water is used for agriculture. However, if the temperature drops below freezing, their water demand can double or triple in the winter because farmers spray their crops with water to keep them from freezing and many homeowners turn on their outdoor faucets to keep their pipes from bursting.

EID's wastewater operations include two treatment plants, 56 sewage pumping stations, and a reclaimed water system. Their plants process an average of four million gallons per day, which is slightly higher in the winter and lower in the summer.

EID's water and wastewater treatment plants have gone through extensive renovations in the past decade and are now highly automated. The plants can run on automatic most of the time, so they only need one eight-hour shift of operators, and the rest of the time the plants are unmanned. This automation makes the plants easier to operate, but it also means that they are relying upon many automated systems, and there are few manual overrides should anything go wrong.

The equipment that EID purchases, and has purchased in the recent past, is all from major, brand name manufacturers because they feel they can rely on these manufacturers to be available long into the future for service and advice. This fact has helped them with their Y2K preparations because the larger manufacturers often have better and more accessible data on whether their equipment is Y2K compliant.

Another technique that has reduced the burden of Y2K remediation is that EID uses as little customized software as possible, because this allows them to utilize the free or inexpensive upgrades that off-the-shelf software manufacturers often provide. They do not use GPS to synchronize computer systems and equipment, so this reduces the number of dates that they have to test for in their Y2K preparations.

2. MOTIVATING FACTORS

EID began work on the Y2K problem in 1997 and has invested a great deal of time and a limited amount of direct expenditures in the project since. While it can be difficult to justify spending money on something for which the typical return on investment cannot be calculated, EID has had a number of factors motivating it on this project. If EID did not go through the remediation process, the results could be disastrous. Sewage could flow in the streets or back up into people's homes, and drinking water could cease to flow, could go untreated, or could be contaminated. All of these scenarios pose major health and environmental risks, for which EID could be held liable.

The California State Department of Health and the California State Water Resources Control Board regulate water and wastewater utilities in the state, and they will not allow any regulatory exceptions for Y2K issues. If EID encounters problems, it can be out of compliance with its permits just as it would be at any other time. EPA oversees water and wastewater utilities too, and they also expect nothing less than business as usual on Y2K dates.

Not only could EID face fines if it is unprepared for Y2K, but it could also face litigation from its customers if it does not exhibit due care in its Y2K preparations. Aside from these concerns, though, is the fact that EID cares about its customers, and its mission is to provide them with safe and reliable drinking water and sewer service. For these reasons EID is doing everything in its power to avoid Y2K problems.

3. GENERAL Y2K PROCESS

3.1 Education and Awareness Building

EID began addressing the Y2K issue by hiring an independent consultant in the fall of 1997 to make an assessment of their potential problem. Like others, EID initially thought of the issue as a computer problem. The consultant made them aware of the full extent of Y2K's reach, though, by identifying and inventorying all the equipment that could potentially be affected. EID had hoped that the consultant would assess which of their equipment was non-compliant, but instead the consultant only helped in the initial inventory phase, where all *potentially* affected items are identified. This is because the consultant made the assumption that all potentially non-compliant equipment was, in fact, non-compliant.

The consultant's estimate for the cost of remediation was $1.8 million. For a utility with revenues of $33 million, this seemed like an extraordinarily high amount. EID therefore decided to look for ways to reduce this cost by addressing the project internally, which it found to be much more efficient and effective. Although the consultant was somewhat alarmist in addressing the Y2K issue, he did help to increase EID's awareness of the magnitude of the Y2K problem, and his report would be helpful later in convincing the EID Board of Directors of the need for more Y2K related funding.

3.2 Y2K Project Organization

In addressing the Y2K compliance project internally, EID initially decided to form a committee of department and division heads. This group proved to be too large and unorganized to manage the problem effectively and coordination was difficult. In addition, the Y2K project placed a burden on committee members, who already had full workloads.

Because of these difficulties, they decided to disband the committee and try a different approach. In the fall of 1998, a full-time Y2K Project Manager position was established to oversee the Y2K compliance project. The Y2K Project Manager and the Director of Information Technology (the Y2K Project Team) were now the point people on the project, and would direct the bulk of the associated work. This relieved the committee members of much of their burden, and made coordination much more efficient.

After the first few months of awareness building and education, the general manager and staff became very involved and supportive. In order to gain information related to Y2K more efficiently, EID made the internet accessible to all of its key employees. This helped in the awareness building because other staff could find information on the Y2K bug for themselves instead of having to get all of their information second hand from the Y2K Project Manager. The employees were encouraged to share the information they found. However, this eventually became too burdensome for the Y2K Project Manager and IT Director because many employees were sending them every article they found, and employees eventually had to be asked to limit the sharing of their findings.

After beginning their own initial assessment of the Y2K Project, the Y2K Project Team observed a natural division in the project between business systems and operations. Much of the assessment and remediation tasks were performed separately on these two sides. More specifically, though, they divided the tasks of the project into four distinct phases, and developed the following action plan:

- Phase I - Preliminary Y2K Assessment and Analysis
  - Risk awareness
  - Project scope and objective assessment
  - Departmental summaries
  - Preliminary inventory
  - Preliminary cost and resource estimates

- Recommendations

(Phase I Final Report completed by outside consultant)

- Phase II - Detailed Impact Analysis, Planning and Design
  - Development of Y2K Project Plan
  - Detailed inventory
  - Preliminary Contingency Plan assessments
  - General conversion and testing schedule
  - Cost estimates for remediation and testing
  - Employee and Rate Payer awareness

- Phase III - Remediation and Testing
  - Replacement of non-compliant equipment and vendors
  - Upgrades of all systems and software
  - Testing of internal systems
  - Testing of water distribution systems
  - Remediation of water treatment and distribution plants
  - Development and implementation of Contingency Plan

- Phase IV - Review and Closure
  - Review of Contingency Plans
  - Simulation of potential Year 2000 service disruption scenarios
  - Review of Project status and expected disruptions

3.3 Funding the Y2K Project

From the beginning EID committed to making all Y2K expenditures long-term investments. They saw Y2K compliance as an opportunity to review systems, upgrade where necessary, and enhance the long-term performance capability of EID in light of any potential risks. EID also avoided the need for additional Y2K specific funds by funding Y2K expenditures from existing budgets as much as possible. This could be done because they made Y2K projects their highest priority and pushed other projects out into the future. Departments still must get approval from the Board for major expenditures before allocating money.

The hardest part of the Y2K process, the Y2K Project Team found, was convincing the Board of Directors of the importance of the problem and the need for funds to address the problem sufficiently. It was the IT Director's responsibility to ask for Y2K related fund allocations, and in working with the Board, he found that the Y2K bug is not just a technical problem, it is more importantly a management problem. If there is understanding and leadership from the top, the technical fixes will follow. However, without adequate understanding of the problem at the management level, the resources to fix technical problems cannot be acquired.

The Y2K Project Team tried numerous approaches to educate the Board about the magnitude of the problem. One tactic was to bring the legal counsel to a meeting to convince the

Board of the potential liability of not practicing due care in Y2K preparations. This was not especially helpful in EID's case because the legal counsel did not become very involved in the issue, but it may be helpful for other utilities in a similar situation.

The Y2K Project Team suggested that one of the most helpful methods for someone trying to convince upper management of the importance of Y2K preparations might be to schedule a block of time for Y2K education and awareness building before meeting about project specifics. At EID, they could not manage to schedule a dedicated block of time, but they tried to increase awareness of potential Y2K outcomes nonetheless. They began a Y2K discussion with the Board by turning off the lights, lighting a candle, and reading a possible outcome for January 1, 2000 if preparations were not complete. This approach seemed to influence the Board, but the timing of the meeting was poor. The Board had just spent a long period of time defending a large rate increase to customers, and they were not in the mood to approve any more expenditures.

Over a series of meetings, the Y2K Project Team got approval for most of the expenditures they felt were necessary, and every time they were denied funding, they found ways to cut costs before asking again. For example, EID had 37 non-compliant PCs, but was denied the funding to replace these by their Board. When departments heard that they did not get funding to replace their old PCs, many of them found room in their own budgets and replaced their non-compliant PCs on their own. The next time the Y2K Project Team went to ask for Y2K funding, they only had to ask for money to replace 10 PCs. In doing this again, the Y2K Project Team would have only approached the Board for funding for the largest expenditures, reducing the number of items on his needs list to the fewest number possible.

4. Y2K REVIEW OF OPERATIONS

Each of EID's operating systems on the water and wastewater sides were reviewed and prepared in the same manner. First, staff inventoried everything in the system that could possibly be affected by Y2K. Second, they inspected each piece of equipment in the inventory (taking housings apart as necessary) to obtain appropriate manufacturer and model number information. Third, they assessed whether the items in the inventory were compliant, usually by searching manufacturer web sites for information, or by contacting the manufacturers directly. Finally, they upgraded or replaced every item for which they could not assure Y2K compliance.

Throughout the Y2K review, energy was and is an important concern. Without electricity, water and wastewater treatment will cease. Therefore EID has been working with its electrical service supplier and has been developing contingencies should supply be disrupted. These issues are discussed in more detail later in this report.

4.1 Wastewater/Water Operations

4.1.1 Inventory

EID started their Y2K water and wastewater systems review by taking an inventory of all potentially affected systems and equipment. The Supervisory Control and Data Acquisition (SCADA) system and the Programmable Logic Controllers (PLCs), which monitor plant operations, the operator interface software, which allows operators to control the equipment electronically, and the PCs at each plant, were all obvious candidates for Y2K review. In addition, there was equipment with embedded chips throughout the District that had to be inventoried. Using the consultant's report as a basis for what sort of devices could have embedded chips, a team of technical and operations staff, along with the IT Director and the Y2K Project Manager, physically searched through each plant and recorded the model number and manufacturer of every possible affected device. Each plant had about 300 to 400 devices to be inventoried. It took them about a day to go through each plant. In addition to inventorying equipment in the plants, they checked equipment outside of the plants, such as the sewage lift pumps, the drinking water pumps, and the equipment in their laboratory.

4.1.2 Assessment/Testing

SCADA systems were checked by attaching a testing device directly to the PLCs, which allowed them to search through every line of programming code for dates. If the date codes in the system had only two digits for the year, they would not be considered compliant. However, they found no date problems in any of their PLCs. Their operator interface software, called WonderWare, did have problems, though. Since WonderWare is off-the-shelf software, they could assess its compliance by simply contacted the manufacturer, who told them that EID's current version was non-compliant and would need to be upgraded.

For the PCs at the plants, the Y2K Project Team checked with their manufacturers, and relied on other material written on the subject. They found that all computers with 486-type processors or earlier were non-compliant. Other PCs had Pentium processors and were compliant but needed a new operating system, or a patch to make their existing operating system compliant.

To assess the Y2K compliance of equipment with embedded chips, the Y2K Project Team usually checked manufacturers' web sites, where they could look up the status of the models that they had recorded. The manufacturers typically state in a special Y2K section of their web page whether each model they made/make is compliant. Manufacturers that did not have web sites were contacted directly. In every case, though, documentation was obtained by either printing out the web page statement, or by asking the manufacturers to send a statement on Y2K compliance.

In their drinking water system, information could not be found in two cases because the manufacturers had gone out of business or had been taken over by another company that was no

longer producing or supporting that equipment. One of these devices was a flow meter at a Federally owned dam that EID manages. The other device was a chlorine analyzer at one of their water treatment plants. While these devices could not be confirmed as compliant or non-compliant, they also found some devices that were non-compliant. Two autodialers, which provide communications links, were described as non-compliant by their manufacturer.

In EID's wastewater system they had one device for which they could not find Y2K information. This was an old circular flow chart in one of their treatment plants. Their main wastewater treatment plant had recently had a $25 million renovation and expansion, so most of the equipment there is new. Their other wastewater treatment plant has also had extensive renovations in recent years, so it also has mostly newer equipment.

4.1.3 Remediation

Their operator interface software could be fixed by installing the WonderWare version 7 upgrade. EID has a maintenance contract with the manufacturer, which covers the cost of all upgrades, so they incurred no expense in making the application compliant. The new version was installed while the old version was still running. This allowed them to test the software by running it in parallel with the old version, but with the control functions disabled. Therefore, if there were any incompatibilities or malfunctions with the new software, it would not affect their operations.

They replaced all of their 486-based computers, and to fix operating system problems, they bought and installed the latest Windows software for all of their PCs. This not only made their computers compliant and more up-to-date, but it also gave them one common operating system, which facilitated the sharing of information throughout the utility.

Altogether, EID had five devices for which they could not assure compliance. The two devices in the water system and the one in the wastewater system for which they could not find Y2K information, were quite old. They were also inexpensive to replace, so they opted to replace them with new, compliant models. To fix the two autodialers that were non-compliant, they simply purchased upgraded firmware chips from the manufacturers and installed them.

4.2 Communication Systems

4.2.1 Inventory

The communication systems are important to both operations and business. Telephone systems, cellular telephones, pagers, two-way radios, and the internet are all used to link operators and administrators together and with the outside world. All of these systems are complex, and could potentially have Y2K problems. Each system had to be broken down into its various components, such as the telephone switches and the peripheral phone units of the telephone system, since different components of a system can have different manufacturers and different compliance statuses.

4.2.2 Assessment/Testing

Their networking equipment was very new so it was assumed to be compliant. Also if there were problems with their internet connection, they could go without it for a long period of time without significant disruption to business or operations. They assessed the compliance of their paging and cellular operations by talking to the service providers. Both providers said they would be compliant, but as with any vendor, they had to decide whether they could trust them. The paging service, they decided, was not critical, because if it was not functioning properly, they could still use their cellular phones or their radios.

They pursued the issue further with Mountain Cellular, their cellular phone service, by sending them a follow up letter, and touring their facilities. After reviewing the information they gained from these sources, they felt confident that their cellular service would work. If it did encounter any problems, they could still use radios to communicate with workers in the field. The manufacturer of their hand-held radios stated that they were compliant, but they also have a repeater in their administrative headquarters, which strengthens signals sent over long distances. They could not determine if this piece of equipment, which was rather old, was compliant.

One system that they found was not compliant, is their telephone system. At each of their locations they have a switch that routes calls within the offices and out of each office. By contacting the manufacturer, they found that several of these switches were non-compliant.

4.2.3 Remediation

They have not yet replaced their radio repeater, but plan to do so this summer. To replace their telephone switches they went to Pacific Bell, their local telephone service provider. Instead of owning the new switches, as they did with their old switches, they are leasing them from Pacific Bell. They feel that this will work better for them because Pacific Bell is better prepared to maintain and service the equipment. This also spreads the cost of the switches out over a long period. The installation and set-up of these switches, however, is still rather expensive. The switch at their administrative headquarters cost $12,000 to replace, the switches at two of their plants cost $3500 each, and the switch at their recreation area will cost $8000 to install. They have already had the switches at their headquarters and plants replaced, but they are waiting until after the summer tourism season is over before installing the switch at the recreation area, in order to minimize disruption there. To save money on the new switches, they had to lose some features, such as four-digit dialing, which allowed anyone at EID to call anyone else in the utility by dialing a four-digit shortcut.

5. BUSINESS SYSTEMS

5.1 Basic Business Hardware and Software

5.1.1 Inventory

All computerized office hardware, such as PCs, copiers, and fax machines, was inventoried for compliance assessment. Some business hardware that had to be inventoried, was outside of the offices, such as the hand-held meter readers, which record the meter readings at customer sites and then load the data into the billing database.

There were many different business software applications to inventory. Every different software application on every computer at EID was recorded into a database by the Y2K Project Manager for compliance assessment.

EID's bank is an important link in its business systems. If its bank has Y2K problems, it will greatly affect EID's ability to do business. EID cannot control the bank since it is external to EID, but it will be discussed, along with EID's other business partners, in section 7, External Influences.

5.1.2 Assessment/Testing

EID checked the Y2K compliance of their office equipment either by forcing the date forward to critical rollover dates, or by contacting the manufacturer. As with the PCs in their plants, they found that the 486-based PCs in their offices were not compliant. They also found that their ten Toshiba laptop computers were not compliant either. EID received assurance from IBM, though, that their AS 400 computer, which EID's financial and customer billing software reside on, was compliant.

The hand-held meter readers were partially non-compliant because, while they would continue to function through the year 2000, they only used two-digit years. The customer billing software they were installing, though, used four digit years. The interface between the meter readers and the software was therefore incompatible.

To check whether software was compliant, as with most equipment, they could usually find the information on manufacturers' web sites. Software was also double checked when possible by moving the date forward on PCs and then testing all the capabilities of the software. Testing could be helpful, but used alone it can also be misleading since malfunctions can be minor in scope and can easily escape detection. Therefore, even when critical business applications were tested, documentation was obtained from the manufacturer. Many applications were found to be non-compliant. EID's customer service and billing software packages were non-compliant, although they were already in the process of replacing these before beginning their Y2K project. Even software that is relatively new, such as Microsoft's Windows 98, can have some minor compliance issues.

5.1.3 Remediation

All of EID's 486-based PCs had to be replaced. Getting funding for all of these was difficult, especially with the ten Toshiba laptops that had to be replaced at the same time. When they first asked Toshiba if there was any way to fix their laptops, they said there was not. However, when they checked with Toshiba again later, they found that Toshiba had designed a chip that could be installed in the laptops to make them compliant. Installing ten chips was much less expensive than replacing ten computers. This was not the only the case where a manufacturer or vendor changed its statement on Y2K, so EID found that it was very helpful to keep checking back with critical partners.

Instead of buying new meter readers, EID decided to keep the current meter readers and to use an interface bridge in the customer billing software that would translate the two digit years of the meter reader to four digit years. This option was available in the version of customer service software that they purchased.

The purchase of new customer service and financial software packages were expensive, totaling about $1.2 million together. However, EID had already decided to purchase both of these upgrades before the Y2K Project had begun, so the funding had already been allocated. In 1997 as they were analyzing bids from suppliers of financial software, they learned of the Y2K bug and made compliance a criteria in their RFP. The financial software was installed in April 1998 but the customer service software was not scheduled to be installed by the year 2000 until they found that their current system was not compliant. Y2K motivated them to upgrade their customer service software earlier. If they had not already funded and planned these upgrades before the start of the Y2K project, they would have had difficulty in completing these upgrades before the end of the year. HTE, the company that sold them the financial and customer service software, has not yet given EID assurance that their software is completely compliant, because it is still in testing. However, if any problems are found, EID will be notified, and HTE will supply them with a fix.

Other software applications that were found to have compliance issues could usually be fixed by a free upgrade or patch if the software was relatively new, or by buying a full upgrade to the newest version if the software was outdated. All operating systems were upgraded to Windows 98 or Windows NT. EID is currently assessing which Windows NT Service Pack to install. There are several Service Pack upgrades available free of charge from Microsoft, but Microsoft has wavered on the Y2K compliance status of each, making it difficult to determine which to install before Y2K. The latest Service Pack is not always the best, because newer ones may have bugs that can corrupt data or applications. For statements on the latest Y2K compliance statuses of Microsoft products go to the Microsoft web page at (http://www.microsoft.com/technet/year2k/product/product.asp).

To check that all of their new and upgraded software and hardware is compliant, they plan to rent out a trailer at a system testing facility this summer where they can run a Y2K test.

For a few thousand dollars, these facilities contain hardware to allow full scale testing of computer and software systems.

6. PUBLIC RELATIONS

EID receives many calls and letters from customers who are worried about Y2K. Some customers want to know how EID is preparing, and what they can do to prepare in case EID encounters disruptions due to Y2K. EID has a standard letter that they send in response to any inquiries, which outlines the work they are doing to prepare for Y2K, and states that they will be as ready as they can be, but cannot guarantee that there will not be problems.

They also address phone inquiries directly. Many of these customers want to know not only how they should prepare for a water/wastewater failure, but how they should prepare for other contingencies as well. EID staff generally tell these people to prepare as they would for any natural disaster, and they refer them to the Red Cross or other emergency relief agencies for further inquiries.

EID has also sent a general Y2K notice out with their billing, and they plan to send another one this summer. This notice not only informs customers about EID's Y2K Compliance Project and their state of readiness, but encourages their customers to "take an active community interest [in Y2K] and to stay informed about Y2K issues." By having an informed public, EID hopes to stem any Y2K related irrational fears that could cause public hysteria in the face of minor Y2K problems. EID is also keeping its employees informed by sending them notices about what to expect from Y2K.

7. EXTERNAL INFLUENCES

7.1 Energy

Some of EID's greatest concerns are blackouts and brownouts. Brownouts can be harmful because they can damage motors and other electrical equipment. Their electrical supplier, Pacific Gas & Electric (PG&E), has spent $160 million on Y2K preparation so far, and says it will be as ready as it can be, but it also expects some unforeseen problems. Although EID is developing contingencies for prolonged electrical outages using backup generators, this can put a severe strain on operations (see discussion under Contingency Planning), and EID would rather keep their contingency plans as a last resort.

EID has stressed to PG&E that water and wastewater utilities must be one of their highest priorities in power supply. They reasoned that disruptions to water and wastewater services can not only cause health risks, but can also cause significant emergency risks if, for instance, fire fighters cannot get water, or if hospitals cannot get potable water. PG&E has acknowledged their

request, but EID feels that there is not enough recognition of the importance of reliable water/wastewater service, and the essential role that power supply plays in that service.

After analyzing PG&E's readiness statements, EID decided that they have to be prepared to run without electricity for several days. Therefore, they are preparing for this contingency, and testing their ability to run their critical operations on generators. These contingency plans are discussed in the section 8, Y2K Contingency Planning.

7.2 Other Vendors

Essential to EID's continuing operation in the Year 2000, is its supply chain. If any of EID's vendors or business partners encounter significant disruptions, it can disrupt EID's ability to function. Therefore, a major part of EID's Y2K preparations was to determine if their vendors would be sufficiently prepared for Y2K.

The Y2K project team checked with vendors by sending them letters, calling them, or reading the statement on their web site. For due care purposes, they asked for a written statement from each vendor. However, also for liability reasons, every vendor told EID that they would be prepared, even though some were inevitably behind in preparing for Y2K. Therefore, EID had to decide whether or not to believe each statement. To help them with this decision, they would often ask to speak with the information technology specialist involved in Y2K preparations at each critical vendor. They could then gauge how much they had already done, and if it looked likely that they would complete preparations by the deadline. (Although January 1 is the "rollover date," September 9, 1999 is the next recognized critical date with possible complications since 9999 is sometimes used as a termination code in programming languages.)

EID found that tracking vendor compliance could be very time consuming. They also found that from the beginning they should have identified their critical vendors, i.e., EID's business or operations would be significantly disrupted if they could not be supplied in a timely manner by these vendors, and only worked with them. At the time of their first mailing, the Y2K project team had not yet identified its critical vendors. They received a wealth of responses from this mailing, but they had to define their group of critical vendors before deciding which of the responses to follow up with, since it would have been too time consuming to follow up with all of them.

EID also found that, as with their equipment manufacturers, they had to continually check up on some vendors, because their Y2K readiness status could change. Their bank was one business partner they felt they had to regularly check up on, because, as the bank went through its Y2K preparations, its electronic transfer methods and mechanisms could change, affecting the way EID did business with them.

As of mid-May, EID felt that 95 percent of its critical vendors were or would be compliant in time for Y2K. At the end of June, if they felt that they could not rely on a vendor's readiness, they replaced the vendor.

8. Y2K CONTINGENCY PLANNING

Although EID expects to be as prepared as they can be for the Y2K bug, they acknowledge that there could be some problems that escape detection or are outside of their control. Therefore, they are developing a contingency plan that covers all of the potential problems that could arise from Y2K. EID had some existing contingency plans for dam breaches, but once they started to concentrate on Y2K, they found that they were very unprepared when it came to risk management. Y2K motivated them to concentrate on the issue, and spurred them to develop contingency plans by a specific deadline. They are now better prepared to deal with all disasters, not just Y2K.

When the Y2K project team started contingency planning, they realized what a daunting task it could be, so they asked their Board if they could hire a consultant to work on the plan. The Board turned their request down, so they decided to do the contingency planning in-house. They started by setting up a meeting schedule with meetings every other week to discuss the plan.

To reduce the amount of work involved in writing a contingency plan from scratch, they searched for an existing plan that they could use as a template. They found many existing contingency plans, ranging in length from just a few pages, to several volumes thick. They eventually settled on a medium length contingency plan (about an inch thick) developed by the California Office of Emergency Services (OES) (http://www.oes.ca.gov/). EID has been modeling its plan after OES's for several months now, and they plan to finish writing it sometime this summer.

8.1 Human Resources

An important part of EID's risk management involves training and preparing their staff, so that they are ready to handle any event in an emergency. From OES they are receiving a free training program called Standardized Emergency Management System (SEMS). Once this program has been completed satisfactorily by the necessary people in the organization, EID becomes a certified emergency response unit. Then, in the event of an emergency, they will be reimbursed for any disaster related expenditures.

The training program consists of 17 modules, with topics ranging from command center organization to terrorist attacks. As part of the program, they are modifying one of their meeting rooms so that it can quickly be converted into an incident command center in the event of an emergency. The training concentrates on organizational structures, so that in an emergency, a chain of command can quickly be set up, and staff nearest to disaster areas can be utilized effectively.

EID opted to include the terrorist training module in their program because they feel that there is a possibility of large numbers of people in their area on New Year's Eve. Many people have gone to Stateline in years past for New Year's celebrations, and this year the celebrations are likely to be larger than ever before. If the roads are too crowded, people may pull off the highways and into the EID's district. Large crowds and Year 2000 service disruptions are a dangerous combination, for which EID feels it must prepare.

To ensure that they have enough staff available to handle any Y2K problems, EID is forbidding any vacations for the last week in December through the first two weeks in January. For the night of New Year's Eve they plan to have a number of staff ready for any problems by holding a get-together at their headquarters for employees and their families. Employees are not required to come, though, so they are not sure how many people will show up.

8.2 Energy

Electricity is one essential supply that EID cannot stockpile. Electricity is also a supply that EID cannot go without for more than a few hours. Since they are not convinced that their electrical supplier, PG&E, will be completely free of Y2K problems, preparing their energy supply for Y2K disruptions comprises the largest amount of their contingency planning.

In examining their energy needs, EID found that it had a number of different time frames to work with. Although EID can supply treated drinking water to most of their customers for five to seven days without electricity, their sewage lift stations can only last a half hour without electricity before they overflow. EID decided that it had to be prepared to be self-sufficient for an indefinite period of time, so they prepared backup generator plans for all of their critical systems. EID already had some generators, but they were drastically under supplied, and many of their existing generators had been run so infrequently that they no longer worked. To address these problems, the Y2K Project Team conducted tests and assessed their generator needs, and drafted an acquisition plan and a cost estimate, which they presented to the Board.

The cost of generator needs totaled more than $285,000, which included purchasing new and used generators, renovations to existing generators, switching components, and EID labor. The Y2K project team had worked hard on their needs plan to reduce cost, and as a result, most of their generator expenditures were approved. They now have five mobile generators for ten water pumping stations, and six mobile generators for nineteen sewage lift stations that did not have backup power generation. All of these stations were fitted with 'quick-connect' switching components, which allow generators to be quickly attached and unattached from each pump. They have developed a plan for rotating their mobile generators through all of their pumping stations in the event of an area-wide power outage. They will run a mock trial this summer to determine whether their rotation plan is practical, or whether they need to purchase or lease more generators.

One generator-related need for which they are still awaiting approval is an upgrade of the generator at their main water treatment plant. They found that the existing generator there was

only connected to their chemical loading system, so none of their other systems there would run in the event of a power failure. To correct for this they connected the generator to all critical systems, increased the amperage capacity on its switching components, and asked the Board for funds to purchase a larger generator, since they estimate that the existing generator has only one quarter of the capacity needed. However, the Board is not convinced that a new generator is needed, so the Y2K team and the plant operators are currently involved in testing the generator's capacity.

The funding for headquarter's generator needs is also pending Board approval. They have one generator that they could use for their network, but it needs $2,500 of renovations, a $3000 automatic switching component, and about $1000 in district labor. The Y2K team has also requested funding for a $24,000 generator (including switch and labor) to supply some of their critical administrative buildings. In total, about $34,000 worth in generator needs are awaiting approval. If they can acquire and install all of these generators, they expect to have enough generating capacity to run their critical systems without electricity for several days. This would not only make EID better prepared for Y2K, but also for power outages due to earthquakes or other natural disasters.

For the night of New Year's Eve, they are preparing contingencies for the possibilities of partial electrical supply failures, or brownouts. Brownouts can cause equipment to run at lower than normal levels, which can damage or destroy some equipment. For this reason, they are currently debating whether to take equipment off the grid and onto generated power, or even to shut it down temporarily on New Year's Eve. If there is no threat of a freeze, which would increase water demand, EID will probably shut their water treatment plants down for a few hours, and will put their wastewater system onto generated power. However, these plans are still under debate.

For EID's fuel needs, they plan to top off all tanks at the end of December. They will also rent an 8000-gallon tank and fill it with unleaded gasoline to supply their trucks. By renting the tank they avoid wasting money on a tank that they will not need in the future. For diesel fuel needs, they can get fuel from a diesel supplier across the street from their headquarters that has above ground tanks, which will continue to supply fuel without electricity.

8.3 Finance

Part of EID's contingency planning addresses possible disruptions with their billing and finance systems. Although a problem with one of these systems may not immediately impact their operations, it soon will if they cannot buy supplies or pay employees, especially if financial problems are compounding on other problems.

EID has contacted all of their suppliers and asked that they be granted a letter of credit for the month of January, so that if they are having difficulty writing checks electronically after January 1, they can still get essential supplies. Since EID has long-term relationships with their suppliers, and their purchasers know their suppliers personally, they found it was easy to get

these letters of credit. Their suppliers were all willing to help out if any Year 2000 problems were encountered.

EID has also decided that it will print out checks for all accounts payable shortly before the end of December, and will them keep them in a safe until they are due to be mailed. This will serve two purposes. First, they can check if their billing software is working properly by comparing the electronic records after the Y2K rollover, and the printed copies from before the rollover. Second, if they find that their software is not working properly, they will have some time to fix it, without being late on any of their already printed payments. Having a high bond rating is very important to EID's finances, so they are especially wary of having any credit problems.

If their financial problems persist for longer than their their pre-written checks last, they can always write checks manually and drive to the bank for transactions. This will be time consuming, but EID expects that any financial systems problems that they could experience will not persist for long. This contingency is only for a worst case scenario.

8.4 Vendors

Although EID is tracking its vendors' Y2K readiness carefully, it must be prepared for disruptions from every one of their suppliers. For supplies that they can stockpile, such as chemicals and fuel, they plan to stockpile as much as possible without encountering any unnecessary expenditures or waste. For example, they plan to stockpile as much chemicals as they can without necessitating more storage space, and without stockpiling more of the short-lived chemicals than can be used before the end of their shelf life. Although most of their chemicals can last indefinitely, one of their chemicals has a shelf life of about thirty days. They are currently trying to get written assurance from their chemical supplier that they will be able to place unusually large orders of chemicals at the end of December. If they cannot get written assurance of this by the end of June, they will start looking for a new vendor.

9. REMAINING Y2K TASKS

As of early June, EID had finished the bulk of its Y2K preparations, although there were still some tasks to be completed. From the action plan described earlier, Phase I was complete. Most of Phase II and much of Phase III had also been completed. The only remaining task in Phase II is the ongoing customer awareness building. This includes responding to inquiries as they come in, and sending Y2K notices out with their billing.

In Phase III there are several tasks to be completed. The testing of EID's customer billing software is being performed remotely, and the schedule is out of their control. This summer, though, EID plans to do some software testing of their own at a special testing facility.

There are still a few remediation tasks to be completed. The telephone switch at EID's recreation area is scheduled to be installed this fall since they plan to wait until after the main tourism season. The central radio repeater also still needs to be replaced, and it is scheduled to be installed this summer. Before performing some remediation tasks, EID must receive funding approval from the Board. There are ten non-compliant PCs that need funding approval before being replaced, and there are also three generators awaiting approval, not including the possible replacement of another generator that is currently being tested for capacity.

EID's other remaining tasks pertain mostly to contingency planning and preparation. EID is in the midst of writing their Y2K contingency plan now, and they are still deciding on some elements of the plan, such as whether to shut down their water treatment plants on December 31, and whether to put their wastewater treatment system on generated power that night. EID employees are currently receiving SEMS training, and staffing plans for New Year's Eve are being finalized. A draft of the Y2K contingency plan is scheduled to be completed this summer, after which it will be practiced and revised as necessary. Final last minute preparations for the Year 2000 rollover include stockpiling chemicals, fuel, and other supplies, and ensuring that an adequate number of staff are ready to respond to any problems.

Appendix - Critical Y2K Dates

DATE	REASON FOR CONCERN
01/01/1999	Systems that look one year ahead may fail.
04/09/1999	Special-use Julian date (99th day of the 99th year).
07/01/1999	Many governments begin their fiscal year.
08/21/1999	Global Positioning System date rollover affects military, transportation, Geographic Information System, and Automatic Vehicle Locator.
09/09/1999	Programmers use 9999 as an end of file or infinity; will cause numerous problems (ninth day of the ninth month of the 99th year).
10/01/1999	Federal government and others begin FY 2000.
12/31/1999	End-of-year baseline (to be used in rollover scenario).
01/01/2000	Date rollover will halt, confuse, or otherwise disrupt many systems and devices.
01/02/2000	First 24-hour look back period.
01/10/2000	First date requiring full use of seven digits.
02/28/2000	Day prior to Leap Year (to be used in rollover scenarios).
02/29/2000	Many systems will not recognize Leap Year in 2000.
02/30/2000	Invalid date. Test to ensure that Leap Year logic is functioning.
03/01/2000	First valid date after Leap Year.
10/10/2000	First date requiring full use of eight digits; may cause failures.
12/31/2000	Some systems using Julian dates may not recognize the 366th day of the Leap Year.
01/01/2001	First date in 2001. Check rollover functions.

Sources: Texas Guidebook 2000 and California Year 2000 Embedded Systems Program Guide.